

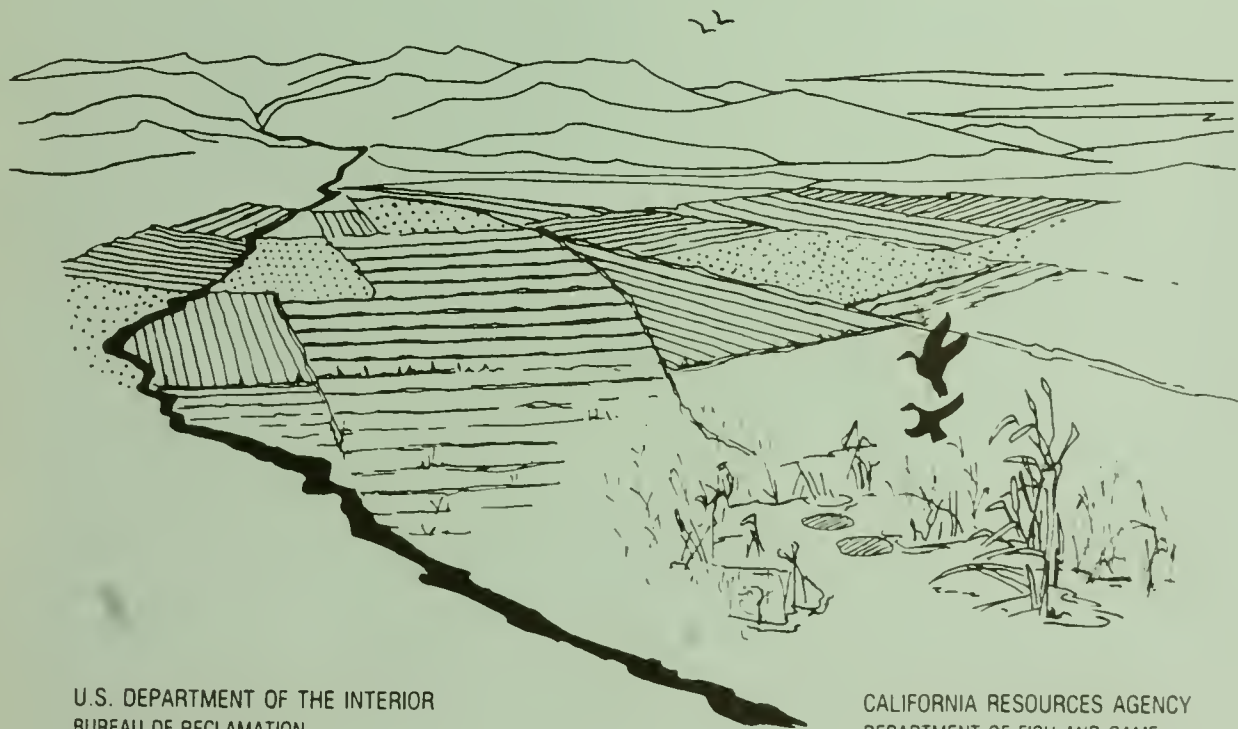
# San Joaquin Valley Drainage Program

---

## APPENDIXES TO PROSPECTUS

---

February 1987



U.S. DEPARTMENT OF THE INTERIOR  
BUREAU OF RECLAMATION  
FISH AND WILDLIFE SERVICE  
GEOLOGICAL SURVEY

CALIFORNIA RESOURCES AGENCY  
DEPARTMENT OF FISH AND GAME  
DEPARTMENT OF WATER RESOURCES



APPENDIX A

MAJOR PREVIOUS STUDIES AND ACTIVITIES  
RELATED TO THE SAN JOAQUIN VALLEY DRAINAGE PROGRAM



MAJOR PREVIOUS STUDIES AND ACTIVITIES  
RELATED TO THE SAN JOAQUIN VALLEY DRAINAGE PROGRAM

San Luis Unit Feasibility and Definite Plan Reports

In 1955, a feasibility report on the San Luis Unit of the Central Valley Project was prepared by the Bureau of Reclamation describing the need for an interceptor drain to protect irrigated farmland in and adjacent to the unit water service area. A Definite Plan Report prepared in 1962 prior to initiation of construction of project facilities discusses the drain with a capability for service to the unit service area as well as adjacent lands.

Firebaugh Studies

In January 1967, the Federal Water Pollution Control Administration (FWPCA) published a report titled "San Joaquin Master Drain - Effects on Water Quality of San Francisco Bay and Delta." As a result of the findings and recommendations in that report, the California Department of Water Resources, FWPCA (now Environmental Protection Agency), and Bureau of Reclamation initiated a 6-year study that ultimately identified technically feasible means of removing nitrate-nitrogen from agricultural drainage. These later became known as the "Firebaugh" studies.

Status of San Joaquin Valley Drainage Problems

California Department of Water Resources Bulletin 127-74, published in December 1974, concluded the State's study of the San Joaquin Valley master drain concept. Several memorandum reports prepared prior to 1974 also discussed the details of the facilities anticipated with regard to a master drain.

San Luis Task Force

Public Law 95-46, enacted on June 15, 1977, created a task force to review the management and operation of the San Luis Unit and to make recommendations for reauthorization. The task force was responsible for analyzing expenditures, design features, replacement obligations, contractual commitments, and fiscal, agricultural, and environmental impacts of the unit. It was directed to examine the record of excess land holdings, residency requirements, and the success of the San Luis Unit in fostering family farms. The conclusions of this task force are contained in its report published in 1978.

## Interagency Drainage Program

The Interagency Drainage Program (IDP) was established in 1975 as a cooperative effort of the California Department of Water Resources, State Water Resources Control Board, and Bureau of Reclamation, with the purpose of identifying an acceptable solution to San Joaquin Valley drainage problems. The IDP report, published in June 1979, concluded that of the 18 alternatives evaluated, a drain with a discharge point near Chipps Islands was the most economical and environmentally acceptable means of disposing of salts from the San Joaquin Valley. The draft environmental impact report included in the IDP report discussed the environmental impacts associated with the four primary elements of the recommended plan. The elements are: (1) Drainage disposal discharge location, (2) the effect of removing drainage from the San Joaquin River, (3) marsh use of drainage water, and (4) the impacts of various uses of the drainage before discharge. Impacts were determined on the basis of intermediate and ultimate drainage quantity and quality for the entire valley.

## San Luis Unit Special Report & Draft Supplement to Final Environmental Statement

A preliminary draft of a Special Report on Drainage and Water Service and Draft Supplement to the 1972 Final Environmental Statement (ES) for the San Luis Unit was completed by the Bureau of Reclamation on June 15, 1984. Because of the need to fully address the issue of drainage water contaminants and their effects on waterfowl at Kesterson Reservoir which surfaced in 1983-84, this report was not finalized, but the data developed for it will be used in the San Joaquin Valley Drainage Program. The purposes of the report were: (1) To provide a basis for congressional action required to expand the San Luis Unit water service area and permit the construction, operation, and maintenance of facilities with sufficient capacity to serve the drainage needs of all lands within both the Delta-Mendota Canal (DMC) and San Luis Unit service areas, and to increase the appropriation ceiling of the unit so that all authorized facilities could be completed, and (2) to supplement the final ES for the San Luis Unit prepared in 1972. The report presents the results of studies conducted to define a plan for completion of San Luis Unit facilities, including estimated costs. It also presents analyses of the following proposed actions: (1) To increase the long-term contractual commitment for firm water supplies to Westlands Water District, (2) to complete an agricultural drainage system to serve lands on the west side of the valley from Kettleman City to the Delta, (3) to reduce salinity in the San Joaquin River by intercepting subsurface agricultural drainage water from lands within the San Luis Unit and DMC service areas now being discharged to the river, and (4) to provide, where feasible, increased wetlands habitat for waterfowl.

## Environmental Study Documents

Several impact study reports relevant to drainage water management in the valley have been prepared, beginning with the FWPCA report on San Joaquin Master Drain Effects on Water Quality of San Francisco Bay and Delta, 1967. The San Luis Unit ES, 1972, discusses some aspects of the San Luis Drain impacts. Since 1972, several technical reports have been prepared for the Bureau of Reclamation on detailed impacts of drainage discharge primarily to the western Delta and Suisun Bay area.







APPENDIX B

AGRICULTURAL DRAINAGE RELATED STUDIES AND ACTIVITIES



List of Agricultural Drainage-Related  
Studies and Activities

---

Number	Project Title
<hr/>	
ALTERNATIVE COMPONENTS	
Disposal	
11010	Deep-Well Injection Concept Study
11020	Evaporation Pond Guidelines
11030	Screening Alternative Geographic Disposal Areas
11050	Siting, Design, and Management Criteria for Evaporation Ponds
11060	Evaporation Pond Investigation
On-Farm Management	
13010	Conference on Long-Range Management Strategies for Soil Salinity in SJV
13020	Distribution of Se & B in Soils Under Various Water Management Practices
13030	Evaluation of On-Farm Agricultural Management Alternatives
13040	Impact of Farm Management Practices on Se Transport
13050	Impact of On-Farm Practices on Toxic Trace Elements
13060	Irrigation Management for Controlling Salts and Potentially Toxic Elements
13070	An Integrated Approach to Farm Water Management
13080	Irrigation Water Management to Control Water and Solute Stress
13090	Irrigation, Drainage, & Ground Water Mgmt for Ag Production in Semi-Arid Regions
13100	On-Farm Management
13110	Optimal Sizing of Subsurface Drainage System Beneath Cotton Crops
13120	Use of Stable Isotopes to Determine GW Recharge Rate for Irrigation Efficiency
13130	Management Practices for Using Brackish Water
13140	Soil, Water, and Salinity Management
13150	On-Farm Management Practices Workshops
13160	Agroforestry Demonstration Program
13170	Westside Drainage Reduction
Reuse	
14010	Effect of Irrigation Quantity and Application on Crop Yield & Se Uptake

## List of Studies and Activities -- Continued

---

Number	Project Title
14020	Furrow Irrigation Using Drainage Water for Processing Tomatoes
14030	Pilot Marsh Study
14040	Reuse of Saline & Se Drainage Waters for Irrigation of Vegetable Crops
14050	Saline Drainage Water Reuse
14060	Use of Agricultural Drainage Water for Powerplant Cooling
14070	Use of Saline Drainage Water for Irrigation

---

### Transport and Storage

15010	Conveyance to Carrizo Plain
15020	Conveyance to Mojave Desert
15030	Alignment and Cost Study of Transporting Drainage Water for Ocean Disposal

### Treatment

16010	Ion Exchange Treatment of Drainage Water
16020	Microalgal Bacterial Treatment of Drainage Water
16030	Pretreatment Turbidity Removal Prior to Reverse Osmosis
16040	Reverse Osmosis Demonstration Desalting Facility
16050	Reverse Osmosis Desalting of Drainage Water
16060	Bench-Scale Selenium Removal -- Algal/Bacterial Process
16070	Utilization of Blue-Green Algae to Remove Se
16080	Selenium Removal by Electron Exchange
16090	Pilot Selenium Removal Plant -- Bacteria
16100	Bench-Scale Selenium Removal -- Bacteria (WR-12)
16110	Bench-Scale Selenium Removal -- Bacteria (WR-13)
16120	Pilot Selenium Removal Plant Using Iron Filings
16130	Iron Filing Treatment of Drainage Water
16140	Bacterial Treatment of Drainage Water
16150	Removal of EDB and Other Pesticides from Ground Water

## CONSTRUCTION & OPERATIONS

### Construction

21010	Desalting and Solar Pond Feasibility
21020	Grassland Water District Distribution System Modifications
21030	Prototype Deep-Well Injection of Drainage
21040	Removal of Selenium and Boron using Algae

List of Studies and Activities -- Continued

---

Number

Project Title

---

Habitat Mgmt/Hazing

22010 Habitat Restoration  
22020 Interim Habitat Management at Kern-Pixley NWR Complex  
22030 Interim Habitat Management at San Luis NWR Complex  
22040 Interim Habitat Mitigation for Kesterson Reservoir  
22050 Nuisance Abatement at Kesterson Reservoir (Hazing)

On-Farm Management

24010 Irrigation Management Assistance

ENVIRONMENTAL STUDIES

Air

31910 Monitoring Airborne Se at Kesterson

Biota

32010 Aquatic Monitoring for Contaminants  
32020 Contamination of Biota in Evaporation Ponds  
32030 Effects of Irrigation Drainage Water on Aquatic Communities  
32040 Expanded Toxic Substances Monitoring Program  
32050 Fish and Wildlife Habitat Surveys  
32060 Grasslands Study  
32070 Microbial Aspects of the Biochemistry of Se  
32080 National Contaminant Biomonitoring Program  
32090 National Wildlife Refuge System Contaminant Survey  
32100 Rate Processes of Phytoplankton from the Northern San Francisco Bay Estuary  
32110 Redirect State Mussel Watch Program  
32120 Sacramento-San Joaquin Delta Interagency Salmon Study  
32130 Sacramento-San Joaquin Delta Mid-Water Trawl Survey  
32140 Sacramento-San Joaquin Delta Neomysis/Zooplankton Study  
32150 Sacramento-San Joaquin Delta Resident Fish Study  
32160 Sacramento-San Joaquin River Delta Striped Bass Egg and Larvae Survey  
32170 Sacramento-San Joaquin River Delta Summer Tow Net Survey  
32180 San Francisco Bay Study  
32190 Selenium in Freshwater Clams at Kesterson  
32200 Trace Metals in Sediments and Benthos

## List of Studies and Activities -- Continued

---

Number	Project Title
32210	USDI Interagency and National Irrigation Drainage Program
32220	Verification of Se in the Biota
32230	Bacterial Resistance to Selenium
32240	Survey of Selenium Contamination in the Grasslands of the Northern SJV
32250	Selenium levels and habitat use of the San Joaquin kit fox in the Kesterson NWR
32910	Kesterson Reservoir Food Chain Surveys (NFCRC)
32920	Kesterson Reservoir Food Chain Surveys (OSU)
32930	Kesterson Reservoir Food Chain Surveys (PWRC)

---

### Crops

33010	Evaluation of Se Accumulation and Se and Salinity Tolerance in Grass Species
33020	Prediction of Se Transfer from Soil-Water into Crops
33030	Protection of Nutrient Uptake in Salt Stressed Barley
33040	Se & Toxic Constituents Distribution in Soil Crops
33050	Se Adsorption & Transport by Plants
33060	Se Levels in Crops
33070	Se Oxidation State & Uptake by Forage Crops
33080	Se in Deciduous Fruit & Nut Crops

### Livestock

34010	Analysis of Trace Elements Including Se
34020	Se Levels in Domestic Animals

### Public Health

35910	Human Exposure to Se at Kesterson Reservoir
35920	Impact of Kesterson Contamination on Human Residents

### Soils

36010	Geochemical Processes Controlling Se Mobility in Soils
36020	Geologic Sources of Trace Elements
36030	Land Resources and Use Program--San Joaquin District
36040	Microbial Transformations in Seleniferous Soils
36050	Modeling B Adsorption-Desorption Processes
36060	Physical & Chemical State of Se in Western SJV Soils
36070	Se Released from Irrigation of San Joaquin Valley Soils
36080	Se Transport in SJV Soils--Influence of Physical Properties
36090	Se Mineralogy



# List of Studies and Activities -- Continued

Number	Project Title
36100	Shallow Ground-Water Chemistry & Hydrology in Panoche Fan Alluvium
36110	Solubility of Se & Other Hydride-Forming Elements
36120	Sorption & Desorption of Selenite & Selenate by Soils of Western SJV
36130	Sources and Distribution of Salts and Trace Elements in Soils of the SJV
36140	Sources of Se and Salinity in Soils & Sediments of Westside SJV
36150	Spatial and Temporal Distribution of Se and Other Trace Elements
36160	Survey of Sources of Se and Other Trace Elements

## Water

37010	Analysis of Agricultural District Discharges
37020	Analysis of Agricultural, Municipal, & Industrial Discharges from Unknown Source
37030	Analysis of Data on Lateral Ground-Water Flow in Westlands Water District
37040	Areal and Depth Distribution of Se in Regional Ground-Water System
37050	California Aqueduct Water Quality Monitoring
37060	Delta Water Supplies Health Aspects and Water Quality Monitoring
37070	Hydrogeology of the Western San Joaquin Valley
37080	Investigation of Unowned Sources
37090	Minor Element Composition of Irrigated Well Waters
37100	Movement and Quality of Shallow Groundwater Relative to Irrigated Agriculture
37110	National Stream Quality Accounting Network (NASQAN)
37120	Occurrence and Transport of Se and Other Trace Elements in the SJR
37130	Regional Aquifer System Analysis II (RASA II)
37140	Regional Modeling of Shallow Aquifers for Salinity Contamination
37150	Sacramento-SJV Delta D-1485 Fixed Site Continuous Monitoring Study
37160	Sacramento-San Joaquin Delta D-1485 Water Quality Compliance Monitoring Program
37170	San Joaquin River Model
37180	San Joaquin River System Water Quality Monitoring
37190	San Joaquin Valley Agricultural Drainage Monitoring
37200	Se Speciation and Redox Parameters
37210	Tulare Lake Drainage District
37220	USBR Continuous Monitoring Sites
37230	Use of Isotopes to Evaluate Water Sources of Drainage Water



## List of Studies and Activities -- Continued

---

Number	Project Title
37240	Water-Quality Monitoring
37250	Selenium Speciation in the Sacramento-San Joaquin Estuary
37260	Broadview Water District Drainage Water Monitoring Program
37270	Biological Assessment of Two Evaporation Ponds in Central San Joaquin Valley
37280	Evaporation Pond Studies
37290	Chemical Species of Selenium in Waters of the San Joaquin Valley
37910	Geochemistry of Se, Its Mobility in Water and Sediments
37920	Kesterson Ground-Water Model
37930	Se Speciation in Kesterson Reservoir
37940	Surface- and Ground-Water Monitoring

---

### MANAGEMENT & SUPPORT

#### Analytical Methods

41010	CDWR Chemistry Laboratory Upgrade
41020	Laboratory Analytical Methods
41030	QA/QC Planning
41040	Laboratory QA/QC
41050	UCD (College of Veterinary Medicine) Chemical Laboratory Analysis Activities

#### Data Management

42010	Coordination & Data Management
42020	Data Base Management System
42030	Development of a California Ground-Water Program Information Directory
42040	Geographic Information System Data for USBR Mid-Pacific Region
42050	National Water Information System (NWIS)
42060	The Socio-Economic-Environmental Demographic Information System
42070	Index to Soil Surveys in California (1986 edition)
42080	STORET
42910	Data Management and Analysis
42920	Western San Joaquin Valley Geographic Information System Pilot Project

List of Studies and Activities -- Continued

---

Number	Project Title
--------	---------------

---

Oversight & Review

43010 National Research Council (National Academy of Sciences)

Program Administration

44010 Management and Supervision -- USFWS  
44020 Management and Supervision -- USBR  
44030 Management and Supervision -- USGS  
44040 Management and Supervision -- CDFG  
44050 Management and Supervision -- CDWR

MISCELLANEOUS

10 Los Banos Grandes Seepage/Drainage

PLANNING

Evaluate Alternatives

55030 South Fork Kings River Project

Formulate Alternatives

54010 Leland Freeborn Watershed Project, Southwest Tulare Basin  
54910 Cleanup Alternatives and EIS Preparation

Inventory

52020 Fish and Wildlife Coordination Act -- SJVDP  
52030 Endangered Species -- SJVDP  
52910 Endangered Species -- Kesterson  
52920 Fish and Wildlife Coordination Act -- Kesterson

## List of Studies and Activities -- Continued

---

Number	Project Title
--------	---------------

---

### Reports

57010	Phase I and II Reports
57910	Cooperating Agency in Kesterson Program

### PUBLIC INVOLVEMENT

#### Participation

64010	Interagency Coordination, Public Information, Technical Assistance, etc.
64020	Public Involvement

### REGULATORY REQUIREMENTS

#### Criteria and Standards

71010	Water Quality Economic Model Development and Usage
71020	Development of Water-Quality Criteria for Se, Mo, & B for the San Joaquin River
71030	Protocol for Setting Effluent Limits of Subsurface Drainage Water
71040	Se Standards for Agricultural Water Supply
71050	Establishment of Selenium Criteria for the San Joaquin River Basin
71060	Ground-Water Component of the San Joaquin River Model

### SOCIAL & ECONOMIC STUDIES

#### Economic

81010	Analyses of Fish and Wildlife Resource Values
81020	Economic Investigations
81030	Regional Economic Impacts
81040	Water Demand and Drainage Production Estimation Study
81050	Engineering Economic Analysis
81060	Private Value Wetland Habitat as a Recreational and Scientific Resource
81070	Non-agricultural Land Use (Public Trust) Valuation Study

## List of Studies and Activities -- Continued

---

Number	Project Title
81080	Agricultural Sector Externalities Studies
81090	Regional Economic Impact Studies

---

### Financial

83010	Financial Investigation & Analysis
83020	Long-term Viability of Agricultural Lands as a Public Trust
83030	Options-on-future Land Use Study
83040	Identifying Financing Alternatives
83050	Studies Involving Equity Concerns

### Institutional

85010	The Relationship Between Various Institutional Policies and Water Use Study
85020	Private and Local Public Wetland Management Behavior Under Alternative Solution

### Social

87010	Ethnographic Study of a High-Risk Population
87020	Social Assessment

## TOXICITY STUDIES

### Biota

91010	Accumulation and Effects of Contaminants on Wintering and Migrating Waterfowl
91020	Accumulation and Loss Rates of Contaminants in Waterfowl
91030	Bioaccumulation and Toxicity of Salt and Trace Elements in CV Aquatic Food Chain
91040	Bioaccumulation of Contaminants in Aquatic Ecosystems
91050	Cu and Cd Toxicity to West Coast Striped Bass
91060	Development of Capability to Predict Contaminant Impacts Upon Wildlife
91070	Ecological Characterization of Evaporation Ponds
91080	Effects of Contaminants upon Susceptibility of Migratory Birds to Disease
91090	Interactive Effects of Contaminants upon Waterfowl
91100	Maximum Safe Levels For Chronic Exposure of Waterfowl to Contaminants

List of Studies and Activities -- Continued

---

Number	Project Title
91110	Migratory Birds' Exposure to Hazard in Evaporation Ponds
91120	Reproduction, Nesting, and Survival of Waterfowl and Other Migratory Birds
91130	Se Toxicity to Chinook Salmon Egg and Fry
91140	Se Toxicity to Chinook Salmon Smoltification
91150	Se Toxicity to Mosquitofish
91910	Bird Condition and Health
91920	Kesterson Reservoir Shorebird Study

---

Crops

92010	Characterization of N Metabolism During Salinity Stress for Muskmelon Varieties
92020	Cloning Salt Tolerant Genes from Elytrigia elongata
92030	Plant Uptake of Toxic Elements in Soils & Sediments of Panoche Fan
92040	Salt Tolerance of Deciduous Fruit Trees
92050	Se Availability & Phytotoxicity in Relation to Chemical Form & Concentration
92060	Uptake of Se & B in Tomatoes

Public Health

94010	Public Health--Interagency Participation
94020	Public Health
94030	Se Content of Maternal and Fetal Tissues
94040	Se in California



## Agency Abbreviations

ARS	Agricultural Research Service
BWD	Broadview Water District
CARCB	California Air Resources Control Board
CCVRWQCB	California Central Valley Regional Water Quality Control Board
CDC	California Department of Conservation
CDFA	California Department of Food and Agriculture
CDFG	California Department of Fish and Game
CDHS	California Department of Health Services
CDWR	California Department of Water Resources
CSUF	California State University at Fresno
CSWRCB	California State Water Resources Control Board
FCH	Fresno County Hospital
KRCD	Kings River Conservation District
LBL	Lawrence Berkeley Laboratory (UCB)
MCHD	Merced County Health Department
NRC	National Research Council
NFCRC	National Fisheries Contaminant Research Center (USFWS)
NPWRC	Northern Prairie Wildlife Research Center
OSU	Oregon State University
PWD	Panoche Water District
PWRC	Patuxent Wildlife Research Center (USFWS)
SDWRA	San Diego Water Reclamation Agency
SJVDP	San Joaquin Valley Drainage Program
UCB	University of California, Berkeley
UCD	University of California, Davis
UCOB	University of Colorado Boulder
UCR	University of California, Riverside
UCSC	University of California, Santa Cruz
USARS	U.S. Agricultural Research Service
USBR	U.S. Bureau of Reclamation
USDA	U.S. Department of Agriculture
USDI	U.S. Department of the Interior
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USSCS	U.S. Soil Conservation Service
VDTL	Veterinary Diagnostic Toxicology Laboratory
WWD	Westlands Water District

## Other Abbreviations

AG	Silver
AG	Agriculture
AS	Arsenic
AVE	Avenue
B	Boron
BA	Barium
BE	Beryllium
BOD	Biochemical Oxygen Demand
C	Carbon
CO <sub>3</sub>	Carbonate
CA	Calcium
CA	California
CD	Cadmium
CL	Chloride
CO	Cobalt
COD	Chemical Oxygen Demand
CR	Chromium
CRVI	Hexavalent Chromium
CTR	Center
CU	Copper
CV	Central Valley
CY	County
D	Digitized Map
DIS	Dissolved
DO	Dissolved Oxygen
EA	Ecological Analysts
EC	Electrical Conductivity
EDB	Ethylene dibromide
EIS	Environmental Impact Statement
EVAP	Evaporation
F	Fluorine
FE	Iron
GIS	Geographic Information System
GW	Ground Water
H	Hydrogen
HCO <sub>3</sub>	Bicarbonate
HG	Mercury
ICP	Inductively Coupled Plasmaemission
K	Potassium
LAB	Laboratory
LI	Lithium
M	Map
MG	Magnesium
MGMT	Management
ML	Milliliter



# Other Abbreviations -- Continued

MN	Manganese
MO	Molybdenum
N	Nitrogen
NA	Sodium
NATL	National
ND	No Data
NH3	Ammonia
NI	Nickel
NO2	Nitrite
NO3	Nitrate
NWR	National Wildlife Refuge
O	Oxygen
OPO4	Orthophosphate
ORG/M3	Organisms Per Square Meter
PB	Lead
PRES	Present
QA/QC	Quality Assurance / Quality Control
RES	Reservoir
RO	Reverse Osmosis
S	Sulfur
SB	Antimony
SE	Selenium
SEIV	Selenium IV
SEVI	Selenium VI
SF	San Francisco
SFKR	South Fork King's River
SiO2	Silica Dioxide
SJR	San Joaquin River
SJV	San Joaquin Valley
SL	Slough
SLD	San Luis Drain
SN	Tin
SO4	Sulfate
T	Tabular
TDS	Total Dissolved Solids
TEMP	Temperature
TL	Thallium
TOC	Total Organic Carbon
TOT	Total
UNK	Unknown
V	Vanadium
VSS	Volatile Suspended Solids
WMA	Wildlife Management Area
WT	Weight
ZN	Zinc

Descriptions of Agricultural Drainage-Related  
Studies and Activities

Number	Project Title	Agency
ALTERNATIVE COMPONENTS		
	Disposal	
11010	Deep-Well Injection Concept Study  Concept-level evaluation of deep-well injection for disposal of drainage.	USBR
11020	Evaporation Pond Guidelines  Develop operational criteria for evaporation ponds used for wildlife.	CCVRWQCB
11030	Screening Alternative Geographic Disposal Areas  Screening of alternative disposal sites on land and surface waters.	USBR
11050	Siting, Design, and Management Criteria for Evaporation Ponds  Develop siting, design, management, and other criteria to minimize or eliminate hazards posed to wildlife by agricultural drainage water evaporation ponds in the San Joaquin Valley.	USFWS
11060	Evaporation Pond Investigation  Develop criteria and guidelines for design and safe operation of evaporation ponds.	CDWR

# Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
On-Farm Management		
13010	Conference on Long-Range Management Strategies for Soil Salinity in SJV  Establish salinity management criteria for SJV; develop procedures to determine physical & economical data needs; develop & evaluate various salinity management strategies.	UCD
13020	Distribution of Se & B in Soils Under Various Water Management Practices  Determine amount of absorbed Se and B accumulated in soils and leached from various crops under different water management practices and model. Augment ongoing study to include Se.	USARS
13030	Evaluation of On-Farm Agricultural Management Alternatives  Literature review; determination of costs and benefits of alternative management methods of reducing subsurface drainage flows; identification of research program to evaluate alternative management scenarios.	USBR
13040	Impact of Farm Management Practices on Se Transport  Analyze Se partitioning in soils and impact of fertilization and soil amendments on Se transport.	USARS
13050	Impact of On-Farm Practices on Toxic Trace Elements  Determine impact of irrigation on movement of trace elements through soil profile, drainage effluent, and within crops. Propose to monitor 13 constituents of concern in irrigated soil profile and drainage effluent used for irrigation.	USARS

# Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
13060	<p>Irrigation Management for Controlling Salts and Potentially Toxic Elements</p> <p>Develop improved irrigation and drainage systems and practices to increase soil and water use efficiencies and to reduce pollution.</p>	USARS
13070	<p>An Integrated Approach to Farm Water Management</p> <p>Develop optimal irrigation schedules concerning yield, soil moisture, salinity, and drainage. Also assess interaction between on-farm management &amp; regional constraints on salt &amp; drainage management.</p>	UCD
13080	<p>Irrigation Water Management to Control Water and Solute Stress</p> <p>Determine water requirements of irrigated cotton, tomatoes, almonds, and grapes. Establish mgmt principles to maximize water-use efficiency. Investigate influence of a shallow, saline water table on irrigation needs.</p>	USARS
13090	<p>Irrigation, Drainage, &amp; Ground Water Mgmt for Ag Production in Semi-Arid Regions</p> <p>Develop integrated water management procedures, methods, and systems for efficient conjunctive use and reuse of water resources in irrigated agriculture.</p>	USARS
13100	<p>On-Farm Management</p> <p>Develop on-farm management practices for a valley-wide solution to drainage problems.</p>	SJVDP

# Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
13110	Optimal Sizing of Subsurface Drainage System Beneath Cotton Crops  Develop model to simulate salt & Se transport through root zone; develop optimal size & placement of subsurface drains.	UCD
13120	Use of Stable Isotopes to Determine GW Recharge Rate for Irrigation Efficiency  Determine the sources and relative contributions of salt to the ground water beneath irrigation projects to reduce salt loading.	USARS
13130	Management Practices for Using Brackish Water  Develop a strategy for facilitating the use of brackish waters for irrigation.	USARS
13140	Soil, Water, and Salinity Management  Develop a rationale for scheduling and management of irrigation.	USARS
13150	On-Farm Management Practices Workshops  To identify those land management practices that would likely be employed under a variety of potential future conditions affecting land management in the San Joaquin Valley.	SJVDP
13160	Agroforestry Demonstration Program  Demonstrate agroforestry systems as an agricultural drainage water management alternative.	CDFA

# Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
13170	Westside Drainage Reduction  To provide consulting services to growers on the west side of the San Joaquin Valley on pre-irrigation evaluations, irrigation scheduling, and salinity measurement.	CDWR
	Reuse	
14010	Effect of Irrigation Quantity and Application on Crop Yield & Se Uptake  Evaluate effects of irrigation water quality and application on crops & soil rooting zone.	USARS
14020	Furrow Irrigation Using Drainage Water for Processing Tomatoes  Evaluate effects of saline drainage water on soluble solids & yields of tomatoes & determine Se increases in soil, plant, & fruit.	UCD
14030	Pilot Marsh Study  Assess the feasibility of using agricultural drainage water for management of wetlands to benefit fish and wildlife.	USFWS
14040	Reuse of Saline & Se Drainage Waters for Irrigation of Vegetable Crops  Assess effect of irrigating crops with drainage water, examine the interaction between Se & specific components of water, determine amount of Se accumulation in crops, & test crop genotypes for tolerance.	UCD



# Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
14050	Saline Drainage Water Reuse  Evaluate effect of drainage water on crop yields & determine effect on soils of Se & other trace elements.	UCD
14060	Use of Agricultural Drainage Water for Powerplant Cooling  Evaluate whether the use of agricultural drainage water for powerplant cooling is a workable corrective measure for the SJV.	SJVDP
14070	Use of Saline Drainage Water for Irrigation  Field research project to evaluate whether saline agricultural drainage water can be used in the irrigation of cotton, wheat, and sugar beets without substantial yield loss.	USARS
Transport and Storage		
15010	Conveyance to Carrizo Plain  Appraisal-level engineering studies for conveyance to and capacity of Carrizo Plain as a drainage disposal site.	SJVDP
15020	Conveyance to Mojave Desert  Appraisal-level engineering studies for conveyance to and capacity of Mojave Desert as a drainage disposal site.	SJVDP
15030	Alignment and Cost Study of Transporting Drainage Water for Ocean Disposal  Appraisal-level studies on routing, conveyances and disposal areas for land and surface water disposal of agricultural drainage.	SJVDP



Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
	Treatment	
16010	Ion Exchange Treatment of Drainage Water  Literature review on ion exchange process for selenium removal.	USBR
16020	Microalgal Bacterial Treatment of Drainage Water  Literature survey and evaluation of microalgal bacterial treatment of drainage water.	UCB
16030	Pretreatment Turbidity Removal Prior to Reverse Osmosis  Small pilot plant at CDWR's Los Banos demonstration desalting facility to test anthracite filtration to remove turbidity prior to reverse osmosis.	CSUF
16040	Reverse Osmosis Demonstration Desalting Facility  Conduct research and pilot plant demonstration of RO, solar ponds, and vapor compression evaporation to desalt agricultural drainage water for reclaimed use.	CDWR
16050	Reverse Osmosis Desalting of Drainage Water  Conceptual-level study of reverse osmosis for desalting of drainage water from the San Luis Drain.	USBR

Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
16060	Bench-Scale Selenium Removal -- Algal/Bacterial Process  Selenium removal research in treatment of drainage with a microalgal bacterial process.	UCB
16070	Utilization of Blue-Green Algae to Remove Se  Investigate the use of various blue-green algae to treat drainage water.	UCB
16080	Selenium Removal by Electron Exchange  Determine the feasibility of using electron-exchange resins as a catalytic agent to remove selenium from drainage water.	USBR
16090	Pilot Selenium Removal Plant -- Bacteria  Field testing to evaluate feasibility of use of anaerobic bacteria for selenium removal.	CDWR
16100	Bench-Scale Selenium Removal -- Bacteria (WR-12)  Research on kinetics of anaerobic bacterial selenium removal.	UCD
16110	Bench-Scale Selenium Removal -- Bacteria (WR-13)  Selenium removal research with aerobic bacteria.	SDWRA
16120	Pilot Selenium Removal Plant Using Iron Filings  Field testing to evaluate the feasibility of selenium removal by adsorption on the surfaces of iron filings.	PWD

# Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
16130	Iron Filing Treatment of Drainage Water  Study technical and economic factors in the use of the iron filing process for the treatment of drainage water.	PWD
16140	Bacterial Treatment of Drainage Water  Study technical and economic factors in the bacterial treatment of drainage water.	WWD/CDWR
16150	Removal of EDB and Other Pesticides from Ground Water  Study the removal of organics with activated carbon.	CSUF/USEPA

## CONSTRUCTION & OPERATIONS

### Construction

21010	Desalting and Solar Pond Feasibility  Evaluate CDWR's existing Los Banos demonstration desalting facility, pilot plant testing, and economic feasibility of reverse osmosis.	WWD
21020	Grassland Water District Distribution System Modifications  Improve system's operational flexibility permitting flow separations to improve water-quality conditions for wildlife habitat.	CDWR

# Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
21030	<p>Prototype Deep-Well Injection of Drainage</p> <p>Construct prototype well to demonstrate feasibility of deep-well injection.</p>	WWD
21040	<p>Removal of Selenium and Boron using Algae</p> <p>Construct prototype system using algal cultures to remove Se and B from drainage water for further treatment and/or disposal.</p>	WWD
Habitat Mgmt/Hazing		
22010	<p>Habitat Restoration</p> <p>Restore the biological health of fish and wildlife habitats damaged by agricultural drainage waters generated by irrigation lands in the San Joaquin Valley.</p>	USFWS
22020	<p>Interim Habitat Management at Kern-Pixley NWR Complex</p> <p>Manage fish and wildlife habitats and populations and public use of those resources to minimize or eliminate harm posed to fish and wildlife resources and people throughout the SJV by agricultural drainage water contaminants.</p>	USFWS
22030	<p>Interim Habitat Management at San Luis NWR Complex</p> <p>Manage refuge fish and wildlife habitats and populations and their public use to minimize or eliminate harm posed to fish and wildlife resources and people throughout the SJV by agricultural drainage water contaminants.</p>	USFWS

# Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
22040	Interim Habitat Mitigation for Kesterson Reservoir  Provide alternative fish and wildlife habitat to mitigate for the loss of 1,200 acres of wetlands at Kesterson Reservoir until a long-term solution is fully in effect.	USFWS
22050	Nuisance Abatement at Kesterson Reservoir (Hazing)  Reduce waterfowl exposure to contaminants at Kesterson Reservoir.	USFWS

## On-Farm Management

24010	Irrigation Management Assistance  Provide technical irrigation system evaluations to growers and recommend improved irrigation practices to reduce drainage flows while maintaining crop productivity.	CDWR
-------	--	------

## ENVIRONMENTAL STUDIES

### Air

31910	Monitoring Airborne Se at Kesterson  Monitoring airborne Se at Kesterson Reservoir. No formal report of results planned.	CARCB
-------	--	-------

# Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
<b>Biota</b>		
32010	Aquatic Monitoring for Contaminants  Determine the geographic extent and severity of contamination of aquatic habitats and organisms created by agricultural drainage waters generated by irrigated lands in the San Joaquin Valley.	USFWS
32020	Contamination of Biota in Evaporation Ponds  Determine the geographic extent and severity of contamination of biota in agricultural drainage water evaporation ponds in the San Joaquin Valley.	USFWS
32030	Effects of Irrigation Drainage Water on Aquatic Communities  Identify distribution of common biota in San Joaquin River and evaluate effects of selenium and other trace elements.	USGS
32040	Expanded Toxic Substances Monitoring Program  To expand and redirect existing fish monitoring to include selenium analysis at selected locations.	CDFG
32050	Fish and Wildlife Habitat Surveys  Determine the past, present, and future quantity and quality of fish and wildlife habitats in the San Joaquin Valley and other areas affected by agricultural drainage water generated in the San Joaquin Valley.	USFWS



# Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
32060	Grasslands Study  Determine the geographic extent and severity of contamination of fish, wildlife, and their habitats throughout the Grasslands area, created by agricultural drainage waters generated by irrigated lands in the SJV.	USFWS
32070	Microbial Aspects of the Biochemistry of Se  Determine if and how microbial reduction of Se occurs in the western San Joaquin Valley.	USGS
32080	National Contaminant Biomonitoring Program  Determine the geographical extent and severity of contamination of fish and wildlife resources.	USFWS
32090	National Wildlife Refuge System Contaminant Survey  Determine the geographical extent and severity of contamination of fish and wildlife resources.	USFWS
32100	Rate Processes of Phytoplankton from the Northern San Francisco Bay Estuary  Evaluate the growth kinetics of phytoplankton in the Bay-Delta as they affect trace element uptake assessment.	USGS
32110	Redirect State Mussel Watch Program  To redirect sampling to focus on selenium analysis in mussels from existing monitoring stations.	CDFG



# Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
32120	Sacramento-San Joaquin Delta Interagency Salmon Study  Measure impacts of a through-Delta water conveyance system on salmon.	USFWS
32130	Sacramento-San Joaquin Delta Mid-Water Trawl Survey  Determine the fall and winter striped bass distribution and abundance.	CDFG
32140	Sacramento-San Joaquin Delta Neomysis/Zooplankton Study  Identify zooplankton and their abundance. Determine Neomysis population levels and size distribution.	CDFG
32150	Sacramento-San Joaquin Delta Resident Fish Study  Determine population dynamics, relative abundance, distribution, habitat preferences, and species associations of resident fish in the Delta.	CDFG
32160	Sacramento-San Joaquin River Delta Striped Bass Egg and Larvae Survey  Determine the striped bass spawning dynamics for the year.	CDFG
32170	Sacramento-San Joaquin River Delta Summer Tow Net Survey  Determine the distribution of young-of-the-year striped bass for an annual index of abundance.	CDFG

# Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
32180	San Francisco Bay Study Develop fisheries data base for future water management decisions.	CDFG
32190	Selenium in Freshwater Clams at Kesterson Analyzed freshwater clams for Se and selected trace elements. Results will be included in the 1987 human epidemiology study.	CDFG/MCHD
32200	Trace Metals in Sediments and Benthos Establish present levels of trace elements in Suisun Bay and compare to control estuary.	USGS
32210	USDI Interagency and National Irrigation Drainage Program Determine the geographical extent and severity of contamination of fish and wildlife resources.	USFWS
32220	Verification of Se in the Biota To verify Toxic Substances Monitoring and State Mussel Watch findings and sample other bay-estuarine biota for Se level.	CDFG
32230	Bacterial Resistance to Selenium The isolation and identification of Se-resistant bacteria from Kesterson Wildlife Refuge is under investigation. The biotransformation of Se salts by these bacteria is also under investigation.	UCOB

Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
32240	<p>Survey of Selenium Contamination in the Grasslands of the Northern SJV</p> <p>Determine the levels and geographical extent of Se and other trace elements in biotic and abiotic components of the West Grasslands Wetland System.</p>	USFWS
32250	<p>Selenium levels and habitat use of the San Joaquin kit fox in the Kesterson NWR</p> <p>To determine the level and extent of exposure of the San Joaquin kit fox in the Kesterson NWR to selenium and other contaminants.</p>	USFWS
32910	<p>Kesterson Reservoir Food Chain Surveys (NFCRC)</p> <p>Determine the levels of agricultural drainage water contaminants in lower food chain organisms at Kesterson Reservoir.</p>	USFWS
32920	<p>Kesterson Reservoir Food Chain Surveys (OSU)</p> <p>Determine the levels of subsurface agricultural drainage water contaminants in the lower food chain organisms and characterize aquatic plant and invertebrate communities at Kesterson Reservoir.</p>	USFWS
32930	<p>Kesterson Reservoir Food Chain Surveys (PWRC)</p> <p>Determine the levels of agricultural drainage water contaminants in the lower food chain organisms at Kesterson Reservoir.</p>	USFWS

# Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
Crops		
33010	Evaluation of Se Accumulation and Se and Salinity Tolerance in Grass Species  Evaluate salt & Se tolerance of commercial grasses for use in improving land & water quality.	UCD
33020	Prediction of Se Transfer from Soil-Water into Crops  Determine Se transfer into crops & develop a transfer function to predict Se content based on soil & water analyses.	UCD
33030	Protection of Nutrient Uptake in Salt Stressed Barley  Assess relationship between nutrient uptake and salt stress.	UCD
33040	Se & Toxic Constituents Distribution in Soil Crops  Evaluate distribution of Se in experimental fields; evaluate Se accumulation in crops & relationship to changing irrigation management.	UCD
33050	Se Adsorption & Transport by Plants  Investigate Se adsorption and translocation to shoots and the incorporation of Se into organic metabolites.	UCD

Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
33060	Se Levels in Crops Evaluate Se Levels in crops from the west side of the San Joaquin Valley.	CDFA
33070	Se Oxidation State & Uptake by Forage Crops Develop procedures for determining Se soil species & their availability to plants.	UCD
33080	Se in Deciduous Fruit & Nut Crops Establish Se range in various plant parts & components for fruit & nut orchards.	UCD
Livestock		
34010	Analysis of Trace Elements Including Se 20% of all Verification of Se Study samples will be analyzed. Other trace elements of concern will be analyzed: B, Mo, As, Cr, Cd, Cu, Zn, Pb, Hg, Ag.	UCD-VDTL
34020	Se Levels in Domestic Animals Evaluate Se levels in domestic animals from the Kesterson area.	CDFA

Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
Public Health		
35910	Human Exposure to Se at Kesterson Reservoir  Analyze blood, urine, and tissue of Kesterson employees and area residents for elevated Se.	MCHD
35920	Impact of Kesterson Contamination on Human Residents  Review of possible health implications of Kesterson Reservoir contamination by agricultural drainage water.	MCHD
Soils		
36010	Geochemical Processes Controlling Se Mobility in Soils  Se mobility in soil of the western San Joaquin Valley.	USGS
36020	Geologic Sources of Trace Elements  Identify and confirm sources and processes of weathering, transporting, and depositing selenium on the west side of the San Joaquin Valley.	USGS
36030	Land Resources and Use Program--San Joaquin District  Prediction of irrigation water usage.	CDWR



# Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
36040	Microbial Transformations in Seleniferous Soils  Study Se transformations; identify & quantify volatile Se products from soils and determine factors affecting Se biomethylation.	UCR
36050	Modeling B Adsorption-Desorption Processes  Evaluate high-B effects on plants & soils & B desorption under leaching conditions; develop and test models predicting B adsorption & desorption in soil.	UCR
36060	Physical & Chemical State of Se in Western SJV Soils  Measure and model Se transformations and transfers.	UCD
36070	Se Released from Irrigation of San Joaquin Valley Soils  Evaluate selenite adsorption-desorption and Se dissolution kinetics.	USARS
36080	Se Transport in SJV Soils--Influence of Physical Properties  Investigation of physico-chemical processes in Se movement through soils.	UCD
36090	Se Mineralogy  Determine the solid phases controlling the aqueous Se chemistry observed in the west side of the San Joaquin Valley.	USGS

# Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
36100	Shallow Ground-Water Chemistry & Hydrology in Panoche Fan Alluvium  Investigate relationship between shallow groundwater flows into drains and distribution of salts and trace elements.	UCD
36110	Solubility of Se & Other Hydride-Forming Elements  Determine effect of salinity on solubility of hydride-forming elements.	UCR
36120	Sorption & Desorption of Selenite & Selenate by Soils of Western SJV  Quantify sorption and desorption of Se as a function of various parameters, develop models.	UCR
36130	Sources and Distribution of Salts and Trace Elements in Soils of the SJV  Compile, evaluate, summarize, and map soil data and geological sources of salinity and trace elements on a valley-wide basis.	UCD
36140	Sources of Se and Salinity in Soils & Sediments of Westside SJV  Identify source of Se and other trace elements in soils and sediments of the west side SJV.	UCR
36150	Spatial and Temporal Distribution of Se and Other Trace Elements  Identify the occurrence and mobility of Se and other trace elements in detail at regional, farm, and field levels in western SJV.	USGS

Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
36160	Survey of Sources of Se and Other Trace Elements  To map sources of Se, As, Hg, Cd, Pb, Zn, Cu, Cr, Mo, Ag, Mn at high priority agricultural and industrial sites.	CSWRCB
	Water	
37010	Analysis of Agricultural District Discharges  Analysis of agricultural drainage from 91 districts.	CCVRWQCB
37020	Analysis of Agricultural, Municipal, & Industrial Discharges from Unknown Source  Analysis of 1,450 water samples from non-point sources.	CCVRWQCB
37030	Analysis of Data on Lateral Ground-Water Flow in Westlands Water District  Compilation of existing ground-water flow data from the west side of SJV.	UCD
37040	Areal and Depth Distribution of Se in Regional Ground-Water System  Assess areal distribution of chemical constituents and ground-water quality from 50-to-700 ft. depth.	USGS
37050	California Aqueduct Water Quality Monitoring  Provide full range monitoring and analysis of water quality in the State Water Project system.	CDWR

Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
37060	Delta Water Supplies Health Aspects and Water Quality Monitoring  Monitor and evaluate Delta water supplies for specific inorganic and organic constituents which are of concern for drinking water sources.	CDWR
37070	Hydrogeology of the Western San Joaquin Valley  Development of geologic framework as the basis for understanding regional hydrology.	USGS
37080	Investigation of Unowned Sources  Documentation of all discharges to and diversions from San Joaquin River.	CCVRWQCB
37090	Minor Element Composition of Irrigated Well Waters  Determine concentrations of selected trace elements in well waters. Document crops containing significant levels of these elements.	UCR
37100	Movement and Quality of Shallow Groundwater Relative to Irrigated Agriculture  Evaluate shallow groundwater flows in relation to agricultural practices. Improve hydrologic and water quality models.	UCD
37110	National Stream Quality Accounting Network (NASQAN)  Monitor stream-flow and water quality bimonthly at Vernalis.	USGS

Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
37120	Occurrence and Transport of Se and Other Trace Elements in the SJR  Quantify the sources, distribution, and transport of trace elements in the San Joaquin River.	USGS
37130	Regional Aquifer System Analysis II (RASA II)  Physical and chemical characterization of the San Joaquin Valley ground-water system.	USGS
37140	Regional Modeling of Shallow Aquifers for Salinity Contamination  Development of management optimization model for salinity control and cost effectiveness.	UCD
37150	Sacramento-SJV Delta D-1485 Fixed Site Continuous Monitoring Study  Water-quality compliance monitoring for decision 1485.	CDWR
37160	Sacramento-San Joaquin Delta D-1485 Water Quality Compliance Monitoring Program  Water-quality compliance monitoring that includes phytoplankton and benthic data.	CDWR
37170	San Joaquin River Model  Develop a model for accretion, depletion, agricultural, municipal, industrial discharge, and diversions for SJR and tributaries.	CSWRCB

# Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
37180	San Joaquin River System Water Quality Monitoring  Evaluate and monitor on a monthly basis the quality of waters at 17 stations on the San Joaquin River and tributaries, including all standard minerals and major trace elements.	CDWR
37190	San Joaquin Valley Agricultural Drainage Monitoring  Provide periodic monitoring of perched ground-water levels and drainage water qualities and quantities including toxic trace elements on the west side of the San Joaquin Valley, primarily in Kings and Kern Counties.	CDWR
37200	Se Speciation and Redox Parameters  Determine dominant species of Se, & redox sensitive parameters and identify speciation processes.	USGS
37210	Tulare Lake Drainage District  Determine the quality of agricultural drainage water discharged to evaporation ponds in the Tulare Lake Drainage District.	USGS
37220	USBR Continuous Monitoring Sites  Measure possible effects of the Central Valley Project on Delta water quality.	USBR
37230	Use of Isotopes to Evaluate Water Sources of Drainage Water  Examine stable oxygen and hydrogen isotopes to identify sources of drainage water containing Se.	USARS



Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
37240	<p>Water-Quality Monitoring</p> <p>Determine the quality of agricultural drainage water that would supply wetlands for the pilot marsh study.</p>	USGS
37250	<p>Selenium Speciation in the Sacramento-San Joaquin Estuary</p> <p>Measurements of dissolved and particulate selenium in water column at San Francisco Bay and Delta-Stations.</p>	CDWR
37260	<p>Broadview Water District Drainage Water Monitoring Program</p> <p>Monitor quality and quantity of agricultural surface and subsurface drainage water in BWD.</p>	BWD
37270	<p>Biological Assessment of Two Evaporation Ponds in Central San Joaquin Valley</p> <p>Analysis of physical parameters and biota growing in evaporation ponds in Kern and Kings Counties.</p>	USSCS/KRCD
37280	<p>Evaporation Pond Studies</p> <p>To develop a model to determine the effect of pond water chemistry on hydraulic conductivity of bed materials. To identify flora and fauna present in agricultural evaporation ponds.</p>	UCD
37290	<p>Chemical Species of Selenium in Waters of the San Joaquin Valley</p> <p>To review Se speciation, transformations, and phase changes in surface waters and sediments in the San Joaquin Valley.</p>	UCSC

# Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
37910	<p>Geochemistry of Se, Its Mobility in Water and Sediments</p> <p>Determine process of algal uptake, reduction and immobilization of Se in Kesterson anaerobic sediments.</p>	LBL
37920	<p>Kesterson Ground-Water Model</p> <p>Provide regional understanding of ground-water movement in the vicinity of Kesterson Reservoir.</p>	USGS
37930	<p>Se Speciation in Kesterson Reservoir</p> <p>Characterization and distribution of 5 Se species from San Luis Drain and Kesterson pond waters including inorganic Se ion. Publication of thesis by Terence Cooke describing Se species from Kesterson water.</p>	UCSC
37940	<p>Surface- and Ground-Water Monitoring</p> <p>Maintain monitoring and analytical facilities to document quality of water entering and leaving Kesterson Reservoir.</p>	USBR

## MANAGEMENT & SUPPORT

### Analytical Methods

41010	<p>CDWR Chemistry Laboratory Upgrade</p> <p>Acquire new "state-of-the-art" analytical equipment to augment existing equipment at the main laboratory to improve sensitivity, rapidity, cost effectiveness, and QA/QC in pesticide and trace element analyses.</p>	CDWR
-------	---	------

# Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
41020	Laboratory Analytical Methods Quality assurance and control methods.	USGS
41030	QA/QC Planning Develop guidelines for QA/QC programs in SJVDP.	SJVDP
41040	Laboratory QA/QC To review and develop quality assurance and control procedures for various analytical laboratories involved in State Se studies.	CSWRCB
41050	UCD (College of Veterinary Medicine) Chemical Laboratory Analysis Activities Provide through interagency agreement for the extension and use of the UCD facilities as a reference laboratory for services to various local, State, and Federal agencies.	CDWR

## Data Management

42010	Coordination & Data Management Provide staffing for coordination and data management of Se studies.	CSWRCB
42020	Data Base Management System Design and implement a data base management system for the San Joaquin Valley Drainage Program.	SJVDP

Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
42030	<p>Development of a California Ground-Water Program Information Directory</p> <p>Creation of an information bank that will catalog all programs, projects, studies, and collections of information/data at the State, Federal, and local level that pertain to ground water in California.</p>	CSWRCB
42040	<p>Geographic Information System Data for USBR Mid-Pacific Region</p> <p>Compile, store, analyze, and output various categories of GIS data in support of USBR studies in the Mid-Pacific Region. Coordinate with other data base management efforts.</p>	USBR
42050	<p>National Water Information System (NWIS)</p> <p>Store water data regularly collected by the Water Resources Division, USGS.</p>	USGS
42060	<p>The Socio-Economic-Environmental Demographic Information System</p> <p>Originally, to manage, store, retrieve, and generate reports from data developed from the 1980 US Census. The data base has been expanded to include the 1980 census data, and various health and economic studies.</p>	LBL
42070	<p>Index to Soil Surveys in California (1986 edition)</p> <p>Provide a list of all known soil surveys and land classification surveys done in California. Develop "A Plan for Soil Conservation" for adoption as official State soil conservation policy.</p>	CDC

# Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
42080	STORET  Offer storage and retrieval capabilities for data generated by any municipal, county, state, or federal agency in the U.S. that chooses to use the system.	USEPA
42910	Data Management and Analysis  Provide mapped and tabular data, and analytical services in connection with information collected during USFWS master planning efforts at Kesterson NWR and stored in a computerized geographic information system (GIS) data base.	USFWS
42920	Western San Joaquin Valley Geographic Information System Pilot Project  Prepare computer-based, study area base maps at 1:100,000 and 1:24,000 scales. Prepare map layers of soil and ground-water characteristics, land use, and related attributes. Develop predictive capability for SJV and the western US.	SJVDP
Oversight & Review		
43010	National Research Council (National Academy of Sciences)  Advisory services on plan development. Scientific oversight of SJVDP. Most work conducted through specialized subcommittees.	NRC

Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
Program Administration		
44010	Management and Supervision -- USFWS  Provide policy guidance, executive and managerial direction, supervision of field operations, liaison with USFWS headquarters offices, interagency coordination, and public information.	USFWS
44020	Management and Supervision -- USBR  Provide policy guidance, executive and managerial direction, supervision of field operations, liaison with USBR headquarters offices, interagency coordination, and public information.	USBR
44030	Management and Supervision -- USGS  Provide policy guidance, executive and managerial direction, supervision of field operations, liaison with USGS headquarters offices, interagency coordination, and public information.	USGS
44040	Management and Supervision -- CDFG  Provide policy guidance, executive and managerial direction, supervision of field operations, liaison with CDFG headquarters offices, interagency coordination, and public information.	CDFG
44050	Management and Supervision -- CDWR  Provide policy guidance, executive and managerial direction, supervision of field operations, liaison with CDWR headquarters offices, interagency coordination, and public information.	CDWR



# Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
--------	---------------	--------

## MISCELLANEOUS

10	Los Banos Grandes Seepage/Drainage  Evaluate potential impacts of seepage from the proposed Los Banos Grandes Reservoir on drainage problems in the Los Banos area.	CDWR
----	---	------

## PLANNING

### Evaluate Alternatives

55030	South Fork Kings River Project  Development of agricultural drainage and conveyance system for evaporation ponds. Purpose is interim relief of drainage and salinity problems impacting agriculture and river water quality.	USSCS
-------	--	-------

### Formulate Alternatives

54010	Leland Freeborn Watershed Project, Southwest Tulare Basin  Study of possible interim solutions for drainage and salinity problems impacting agriculture in three local districts. On-farm management and/or a subsurface drainage and conveyance system for evaporation ponds are being considered.	USSCS
-------	---	-------

# Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
54910	Cleanup Alternatives and EIS Preparation  Develop an acceptable plan to close and clean up San Luis Drain and Kesterson Reservoir.	USBR
Inventory		
52020	Fish and Wildlife Coordination Act -- SJVDP  Advise construction, mgmt, regulatory, and other public and private parties on the effects of proposed actions upon fish and wildlife resources, and make recommendations on enhancement and mitigation.	USFWS
52030	Endangered Species -- SJVDP  Review alternative plans, provide information on Federally listed endangered and threatened species, and give opinions and recommendations on the effects of those alternatives.	USFWS
52910	Endangered Species -- Kesterson  Review alternative clean-up plans, provide information on Federally listed endangered and threatened species, and give biological opinions and recommendations on the effects of those alternatives upon those species.	USFWS
52920	Fish and Wildlife Coordination Act -- Kesterson  Participate in the development and review of alternative clean-up plans, assess effects upon fish and wildlife resources, and recommend actions to mitigate adverse effects and enhance those resources above mitigation levels.	USFWS

# Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
--------	---------------	--------

## Reports

57010	Phase I and II Reports	SJVDP
-------	------------------------	-------

Present and evaluate alternatives and a recommended plan for management of agricultural drainage-related problems in the western San Joaquin Valley.

57910	Cooperating Agency in Kesterson Program	USFWS
-------	---	-------

Serve in the role of a cooperating agency in the development of the EIS and Closure and Post-closure Maintenance Plan for the clean up and long-term disposition of Kesterson Reservoir and San Luis Drain.

## PUBLIC INVOLVEMENT

### Participation

64010	Interagency Coordination, Public Information, Technical Assistance, etc.	USFWS
-------	--	-------

Coordinate with other agencies, inform the public, and provide managers of private wetlands with technical assistance in management of those habitats in the presence of contaminated agricultural drainage water.

64020	Public Involvement	SJVDP
-------	--------------------	-------

Conduct a public-involvement program in support of SJVDP activities. Conduct information workshops, facilitate the Citizens' Advisory Committee, and arrange public meetings as needed.

# Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
REGULATORY REQUIREMENTS		
Criteria and Standards		
71010	Water Quality Economic Model Development and Usage  Analysis of economic impacts of potential water-quality objectives and alternative water management facilities associated with the San Joaquin River.	CSWRCB
71020	Development of Water-Quality Criteria for Se, Mo, & B for the San Joaquin River  Evaluate toxicity of Se, B, and Mo to plants, fish, and wildlife. Element-specific criteria will be developed for SJR Basin.	CSWRCB
71030	Protocol for Setting Effluent Limits of Subsurface Drainage Water  Development of a protocol for establishing a water-quality criterion, a water-quality standard, and an effluent limit to protect aquatic organisms in fresh, brackish, and marine waters.	USBR
71040	Se Standards for Agricultural Water Supply  Develop Se standard for crops irrigated with drainage water.	CCVRWQCB
71050	Establishment of Selenium Criteria for the San Joaquin River Basin  Establishment of Se criteria based on bioaccumulation factors for fish and wildlife.	CSWRCB

# Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
71060	Ground-Water Component of the San Joaquin River Model  Develop input-output model to estimate waste loads to the San Joaquin River and their impact on water quality.	CSWRCB
SOCIAL & ECONOMIC STUDIES		
Economic		
81010	Analyses of Fish and Wildlife Resource Values  Identify and evaluate the values associated with fish and wildlife resources that occur in the SJV and are, have been, or could be affected by mgmt of ag drainage water generated by irrigated lands in the valley.	USFWS
81020	Economic Investigations  Develop economic analysis of each plan's benefits and costs, including environmental.	SJVDP
81030	Regional Economic Impacts  Quantification of economic effects of alternative plans on local, regional, national entities.	SJVDP
81040	Water Demand and Drainage Production Estimation Study  This study examines the relationship of farmer decision-making to on-farm water management options and drainage quantity and quality production.	SJVDP

# Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
81050	Engineering Economic Analysis  These studies compare the costs and returns to farming investment under various drainage reduction and regulatory constraint scenarios.	SJVDP
81060	Private Value Wetland Habitat as a Recreational and Scientific Resource  This study will examine the market values of fish and wildlife habitats in the San Joaquin Valley.	SJVDP
81070	Non-agricultural Land Use (Public Trust) Valuation Study  This study examines the value of additional wetland habitat within the San Joaquin Valley.	SJVDP
81080	Agricultural Sector Externalities Studies  These studies will identify and examine the positive and negative values that are produced by agricultural activities but not reflected in market type transactions.	SJVDP
81090	Regional Economic Impact Studies  The regional economic impact studies will examine the economic impacts of each alternative solution in terms of income, employment, and tax revenues from state and regional prospectives.	SJVDP



Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
Financial		
83010	Financial Investigation & Analysis  Develop a basis for cost allocation, cost sharing, and repayment for preferred alternative.	SJVDP
83020	Long-term Viability of Agricultural Lands as a Public Trust  This study will examine a rationale for public expenditures that assures future agricultural productivity and associated public benefits.	SJVDP
83030	Options-on-future Land Use Study  This study incorporates the results from projects 81070 and 83020 to identify optional mixes of land uses from a temporal and marginal economic value perspective.	SJVDP
83040	Identifying Financing Alternatives  Financial alternatives studies, based on a cost allocation, will explore a variety of cost-sharing and repayment arrangements.	SJVDP
83050	Studies Involving Equity Concerns  Equity issues resulting from financial alternatives will be considered in order to identify the public's willingness to pay for investments whose major benefits may not be realized by society at large or for many years.	SJVDP

# Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
Institutional		
85010	The Relationship Between Various Institutional Policies and Water Use Study  This study examines the relationship between various institutional policies, laws, and regulations and agricultural water use.	SJVDP
85020	Private and Local Public Wetland Management Behavior Under Alternative Solution  This study will examine how wetland managers will respond to alternative drainage related solutions.	SJVDP
Social		
87010	Ethnographic Study of a High-Risk Population  Ethnographic studies of a high-risk population around Kesterson Reservoir.	UCD
87020	Social Assessment  Compile baseline data to facilitate plan formulation & decision-making process; identify impacts; identify mitigation.	SJVDP

# Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
TOXICITY STUDIES		
Biota		
91010	Accumulation and Effects of Contaminants on Wintering and Migrating Waterfowl  Determine the short- and long-term effects of agricultural drainage water contaminants upon waterfowl mortality and recruitment.	USFWS
91020	Accumulation and Loss Rates of Contaminants in Waterfowl  Determine: a) How rapidly waterfowl take up SJV ag drainage water contaminants, b) what levels are accumulated during the winter, and c) how long contaminants are retained in the body.	USFWS
91030	Bioaccumulation and Toxicity of Salt and Trace Elements in CV Aquatic Food Chain  Determine Se toxicity in lab under varying conditions & verify in field; determine toxicity of other return water toxicants.	UCD
91040	Bioaccumulation of Contaminants in Aquatic Ecosystems  Determine the fate, effects, and residue accumulation of Se species; major abiotic and biotic factors controlling Se speciation; and biological availability, pathways, and persistence of Se species in simulated food chains.	USFWS

Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
91050	<p>Cu and Cd Toxicity to West Coast Striped Bass</p> <p>Determine the toxicity of agricultural drainage water constituents, both singly and in combination, to fish and aquatic invertebrates.</p>	USFWS
91060	<p>Development of Capability to Predict Contaminant Impacts Upon Wildlife</p> <p>Determine what concentrations of agricultural drainage water contaminants in the environment and in fish and wildlife tissues are associated with what types and degrees of reproductive impacts, mortality, and other effects.</p>	USFWS
91070	<p>Ecological Characterization of Evaporation Ponds</p> <p>Characterize the biological communities and key ecological processes occurring in agricultural drainage water evaporation ponds in the SJV.</p>	USFWS
91080	<p>Effects of Contaminants upon Susceptibility of Migratory Birds to Disease</p> <p>Determine the effects of agricultural drainage water contaminants upon the susceptibility of migratory birds to diseases.</p>	USFWS
91090	<p>Interactive Effects of Contaminants upon Waterfowl</p> <p>Determine the proportions of various contaminants in SJV vegetation, invertebrates, and fish influenced by agricultural drainage water; and short- and long-term effects of those contaminants upon adult and young waterfowl.</p>	USFWS

# Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
91100	Maximum Safe Levels For Chronic Exposure of Waterfowl to Contaminants  Determine the lowest levels of Se, B, and other agricultural drainage water contaminants that produce a significant effect on various life stages of waterfowl.	USFWS
91110	Migratory Birds' Exposure to Hazard in Evaporation Ponds  Determine the use (eg. type, frequency, numbers, species, etc.) of agricultural drainage water evaporation ponds in the San Joaquin Valley by migratory birds.	USFWS
91120	Reproduction, Nesting, and Survival of Waterfowl and Other Migratory Birds  Determine the effects of agricultural drainage waters in Kesterson Reservoir upon reproduction, nesting, and survival of waterfowl and other aquatic migratory birds.	USFWS
91130	Se Toxicity to Chinook Salmon Egg and Fry  Determine the toxicity of agricultural drainage water constituents, both singly and in combination, to fish and aquatic invertebrates.	USFWS
91140	Se Toxicity to Chinook Salmon Smoltification  Determine the toxicity of agricultural drainage water constituents, both singly and in combination, to fish and invertebrates.	USFWS
91150	Se Toxicity to Mosquitofish  Determine the toxicity of agricultural drainage water constituents, both singly and in combination, to fish and invertebrates.	USFWS

# Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
91910	Bird Condition and Health  Assess tissue and biochemical changes of birds collected at Kesterson Reservoir.	USFWS
91920	Kesterson Reservoir Shorebird Study  Determine the effects of agricultural drainage water contaminants in Kesterson Reservoir upon survival of selected shorebirds until fledging.	USFWS
Crops		
92010	Characterization of N Metabolism During Salinity Stress for Muskmelon Varieties  Test the hypothesis that ammonia accumulates to a toxic level in leaves of salt-sensitive but not salt-tolerant varieties during salinity stress.	UCR
92020	Cloning Salt Tolerant Genes from Elytrigia elongata  Obtain, characterize, and map salt-tolerant genes from E. elongata.	UCD
92030	Plant Uptake of Toxic Elements in Soils & Sediments of Panoche Fan  Locate sources of toxic elements; determine soil conditions influencing transformation of Se & find soil treatments to reduce levels in drainage; assess plant uptake of trace elements.	UCD



# Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
92040	Salt Tolerance of Deciduous Fruit Trees  Determine effects of various levels of salinity on fruit yield, quality, & vegetative growth; determine components of vegetative & reproductive responses; measure changes in plant tissue quality when grown under varying soil salinities.	UCD
92050	Se Availability & Phytotoxicity in Relation to Chemical Form & Concentration  Determine Se crop uptake & accumulation in relation to species & form; determine concentration associated with phytotoxicity.	UCR
92060	Uptake of Se & B in Tomatoes  Determine if uptake of Se and B in tomatoes can reach levels toxic to humans.	USARS
Public Health		
94010	Public Health--Interagency Participation  Participate in interagency meetings and studies and perform lab analyses and risk assessment for a variety of projects as requested.	CDHS
94020	Public Health  Protection of human health, monitoring select populations in the study area, and food product analysis.	USBR

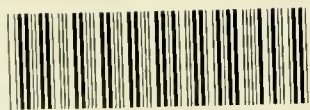
# Descriptions of Studies and Activities -- Continued

Number	Project Title	Agency
94030	<p>Se Content of Maternal and Fetal Tissues</p> <p>Determine Se levels in aborted fetuses from "low" and "high" Se areas and relationship between maternal blood Se and fetal tissue Se and spontaneous abortion rates.</p>	FCH
94040	<p>Se in California</p> <p>Summarize sources, movement, fate, and environmental and health consequences of Se.</p>	UCR









P00001839